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Young workers' overeducation and cohort effects in "P.I.G.S." countries versus the Netherlands: a pseudo-panel analysis

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Abstract: According to theoretical and empirical evidence young workers are more likely to be overeducated than adult ones, especially in countries where the educational attainments of young people grow quickly and the school-to-work transition is difficult and/or lengthy.
Nonetheless, if overeducation were expected to disappear during working life, it would not be a crucial problem.
To test the transitory nature/persistence of this phenomenon, firstly, I estimated overeducation using the competences frontier method and, later, I studied the "destination" of different cohorts of workers by applying a pseudo-panel technique to Eurostat data referring to European Mediterranean countries and the Netherlands.

JEL: J21, J24, J31

Key words: overeducation, transitoriness, youth employment, cohort effects, returns to education

1. Introduction

During the last few decades European Mediterranean countries (Portugal, Italy, Spain and Greece, the so-called "P.I.G.S." countries[1]) have been characterised by fast growth in educational attainments of the population and difficulties in integrating young people into the labour markets. Both these characteristics could generate problems of overeducation for the youngest cohorts of workers.

In this framework, we should clarify if the rapid growth in the average level of education has been driven by an effective requirement for a more highly educated workforce (from the labour-demand side point of view), or if it has been the result of a simple "supply effect"[2]. In the former case the growth of educational attainments would reflect the necessity for workers (and firms) to adapt to incessant technological and organizational changes in a dynamic labour market, whilst in the latter case it would be the outcome of autonomous decisions to invest in human capital taken by individuals and families. Such being the case, the educational system and the production system

[1] . The Economist, June 5, 2008, "The ECB at ten: A decade in the sun".
[2] . See Frey, Ghignoni and Livraghi, 1998, and related bibliography.

dynamics could be largely independent from each other[3], and labour demand would just draw the newly hired workers from a population where highly educated individuals are becoming more and more numerous. Obviously, if the "supply effect" exceeds the "demand effect", overeducation emerges and it would affect, above all, the more educated young workers.

In addition, part of the literature points out the link between overeducation and labour market characteristics at local level[4]. In this framework, the incidental difficulty of young people entering the local labour market could worsen the problem of young workers' overeducation. In particular, a local labour market characterised by high youth unemployment rates and a difficult and lengthy school-to-work transition, could induce (well-educated) young people to settle for jobs not fitting their level of education. Moreover, in this situation it would be easier for employers to re-categorize jobs as requiring a degree, when they were previously filled by non-graduates, without altering the pay scale accordingly (Di Pietro and Urwin, 2006).

The main idea of this paper is that, even in countries where young people find it difficult to enter the labour market, overeducation should be a *persistent* phenomenon only if the growth in education level of the labour force is greater than the growth of the educational quality of jobs (Groot, 1996), that is, only in those cases where the growth in the educational attainments of the population is due to a supply-side effect, rather than a demand-side effect.

A highly-skilled demanding local labour market, by providing good jobs and career opportunities, should reduce the risks of *permanent* overeducation. In this case individuals' overeducation might be higher for younger workers, due to difficult entry conditions, but it should diminish during working life as workers move along their career paths[5]. Thus, we should expect that different cohorts of individuals will have experienced overeducation, at the most, at the beginning of their working life, and that overeducation shows a progressive reduction, as different cohorts move to more demanding jobs in which they make full use of their qualifications.

This paper aims to analyse how these elements (supply or demand-driven growth of education in the labour force and marginalization/integration of young people in the labour market) interacted in determining youth overeducation and the evolution of overeducation for the youngest cohort of workers in Mediterranean countries and in the Netherlands.

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[3] . For example, Carnoy and Levin, 1985, show that the evolution of the educational system in the USA would be characterised not only by the attempt to match workers' human capital to firms' needs but, above all, to meet the need of assuring equal opportunities to individuals.

[4] . Part of this literature is linked to workers' limited spatial mobility. If their job seeking takes place at local level they will be exposed to higher risks of overeducation. This may be the case, in particular, of married women in a gender segmented labour market (Frank, 1978). Generally, it does not seem to be the case of young workers.

[5]. Sicherman, 1991; Alba-Ramírez, 1993. To confirm the relevance of the educational structure of labour demand, some authors point out that individuals characterised by a high number of job changes do not always enjoy a progressive reduction of overeducation (Sloane et al., 1999).

This paper contributes to the literature in at least three ways. Firstly, I use an extensive and homogeneous survey (ECHP), which provides comparable data on many European countries, to explore the incidence, the effects and the evolution of overeducation in five countries. As a matter of fact, ECHP has been designed in order to allow comparisons in space and time and it facilitates the interpretation of results obtained on very different socio-economic contexts. Nonetheless, previous analysis of overeducation based on ECHP data failed to fully exploit the potential of this dataset. Indeed, some authors explored the incidence and/or the wage effects of overeducation in various EU countries in a static framework (i.e. referring to a single wave of the survey; Di Pietro, 2002; Budrìa and Moro-Egidio, 2007; 2009), while other authors analysed the persistence of overeducation over a three-year period referring to a single country (Alba-Ramírez and Blázquez, 2003). Secondly, I extend the analysis of the persistence of overeducation over a longer period of time (1995-2001) than documented in previous literature[6]. Given that the absorption of overeducation through career mobility can take a long time in several countries, this seems to be a non negligible issue. Thirdly, I do not rely the analysis on a subjective measure of overeducation, which is increasingly subject to criticism (Borghans and de Grip, 2000) even if largely utilised in economic literature. Instead, I propose a measurement of overeducation which takes into account an important factor of individual heterogeneity such as on-the-job experience, and I check the robustness of my results by relying on a more standard measure of overeducation.

The paper is organised as follows. Section 2 presents relevant macroeconomic data. Section 3 contains a brief discussion of the theoretical framework of overeducation. In section 4 I focus on the choice of a suitable overeducation indicator. In particular, I choose to estimate overeducation through the "frontier of competence" model (sections 5 and 6). After estimating the incidence of overeducation and its consequences on wages (section 7), I apply a pseudo-panel technique to Eurostat data in order to analyse the destination of different cohorts of workers in the observed countries (section 8).

Results show that in the Netherlands and in Spain (where the "demand-effect" seems to overcome the "supply-effect") the last cohorts of entrants enjoyed a progressive reduction of overeducation, in spite of the entry conditions for young people in the labour market being as difficult in Spain as in other Mediterranean countries. This reduction was not observed in Italy, Greece and Portugal.

[6] . Alba-Ramírez and Blázquez (2003) studied job-match transitions in Spain from 1995 to 1997, whilst Groot and Van den Brink (2003) estimate a Multinomial Logit Model on the persistence of overeducation from 1994 to 1996 in Dutch labour markets.

2. A quick look at relevant macroeconomic data

The analysis of OECD data provides an overview of the evolution of individuals' human capital in the four Mediterranean countries in comparison with other European and 'extra-European' countries during the last decade[7].

In 1996, as in 2006, P.I.G.S. countries were characterised by a very low percentage of individuals with at least upper secondary education in both the 25-64 and the 25-34 year old age groups. Nonetheless, during this decade they have been characterized by *a very strong increase in the percentage of 25-34 year olds attaining an upper secondary degree*. The growth of the percentage of young people holding a tertiary education degree was slower, with Spain being the exception. By contrast, the Netherlands started at a much higher level of aggregate human capital and its growth during the observation period was more moderate.

As previously mentioned, in this paper I tried to establish whether the rapid evolution of young people's educational attainments in Mediterranean countries, enlightened by OECD data, is due to a "demand effect" or if it is simply the outcome of a "supply effect". To this aim, in the next sections of this paper I perform an econometric analysis of overeducation that, taking into account the evolution of the employment structure by educational level in P.I.G.S. countries and in the Netherlands, is able to disentangle the demand effect from the supply effect. Nonetheless, "first symptoms" of the prevalence of the supply effect in some Mediterranean countries can be read in the macroeconomic data reported in table 1.

Some authors point out that EU Member States have adopted different work organization models that are likely to require different levels of workers' human capital. In particular, on the basis of 2000 data from the third wave of the European Working Conditions Survey, Lorenz and Valeyre (2003) propose a typology of four forms of work organization in Europe (see table 1), which are labelled as: (1) learning, (2) lean, (3) Taylorist, (4) traditional. "Advanced organizations" (or "high-performance" organizations) can be loosely identified with the "learning" and "lean" forms. These organization forms are characterized by a good level of autonomy, task complexity, learning and problem solving, and by a certain degree of teamwork and job rotation. By contrast, Taylorist and traditional forms of organization are associated with high levels of task monotony and tend to require a less educated workforce than advanced organizations. In this framework, table 1 shows that in Greece, Italy, Portugal and Spain the percentage of employees in "advanced" forms of organization is the lowest in the EU-15, far from the EU-15 average level (67.3%), whereas the percentage of employees in Taylorist and traditional organization forms is greater in these countries than in the EU-15 average (respectively: 13.6% and 19.1%). Nonetheless, it is worth noticing that Spain is characterised by a far higher percentage of employees in "lean production" organizations

[7] . Compare OECD, 1998, p. 44 and OECD 2008, pp. 43-44.

than other Mediterranean countries. By contrast, in the Netherlands advanced forms of organizations are more than 81%, whereas traditional forms represent only 13.5%.

As outlined above, the difficulty in integrating young people in the labour market could worsen their risks of overeducation. In this regard different sources of data depict difficult employment situations for young people in the four Mediterranean countries. In particular, Eurostat data[8] show that, between 2000 and 2005, youth unemployment rates in Greece, Italy, Spain and Portugal were nearly the highest in Europe, even if Spain had a clear reduction during the same period. Moreover, the gender gap in youth unemployment rates in Mediterranean countries was nearly the highest in Europe in 2000 and it further worsened in 2005. Even with regard to this aspect, Dutch labour markets differ greatly from Mediterranean ones. The youth unemployment rate in the Netherlands, even if with a slightly increasing trend, is quite low (from half to less than a third of those in P.I.G.S. countries in 2005), and the gender gap, nearly the lowest in Europe, has further declined between 2000 and 2005. In general, youth unemployment is higher than that of adults (2.5 times in the EU-27 average). Nevertheless, the ratio of youth-to-adult unemployment rate is far above the European average in all Mediterranean countries, especially in Italy and in Greece.

Another important indicator for evaluating youth conditions in the labour market was provided in a recent paper by Quintini et al. (2007) which estimated the average duration (in months) of the transition from school to work in a number of European countries[9], by identifying the time spent to find *any* job and the time spent to find a *permanent* job. These authors note that Italian, Greek, Portuguese and Spanish young workers are those who spent (in 1994-2000) the longest amount of time finding a permanent job after leaving full time education in Europe. Even by utilising more recent LFS data on school-to-work transitions[10], the situation does not show a radical change (see Employment in Europe, 2007, chart 28). On average, almost two-thirds of the youth completing their education in the EU get a job one year after leaving school, but the school-to-work transition seems to work better in some countries than others. In the Netherlands more than 80% of young people get a job one year after leaving the educational system, while in Spain this quota is a little bit above 50% and in Greece and Italy less than 50% of young non-students are employed a year after leaving permanent education. The situation in Portugal seems to be more or less aligned with the EU average.

In conclusion, the macroeconomic data analysed in this section show faster growth in the aggregate human capital of the youngest cohorts of workers in Portugal, Italy, Spain and Greece than in the Netherlands, even if Taylorist and traditional forms of organization are still widely

[8] . See Web Site Eurostat, 2000-2005.
[9] . For a complete list of school-to-work-transition indicators, see O'Higgings, 2008.
[10] . LFS Eurostat data allow calculating the labour market status of young people one year after leaving school.

diffused in Mediterranean countries, with the partial exception of Spain where "lean productions" reached a considerable spread. This could mean that in some Mediterranean countries employers might have been unable to quickly modify production technologies and organization forms in response to a significant and rapid rise in the numbers of highly educated individuals. Thus, the growth of educational attainments of the population might have been driven by "supply effects" more than "demand effects" and might have generated risks of overeducation for young workers. Moreover, in P.I.G.S. countries young people experienced a long and difficult school-to-work transition which might have forced some of them to accept badly-matched jobs, worsening the risks of youth overeducation.

By contrast, the Netherlands has been characterised by a slower recent growth of aggregate human capital, along with a high share of "advanced organizations", a faster school-to-work transition and easier integration of young people in labour markets (and in society), thanks to, among other things, a widespread system of flexicurity[11]. Thus, Dutch labour markets seem to be on track in reducing young workers' risks of (permanent) overeducation.

3. Overeducation: theoretical frameworks

Overeducation describes the extent to which an individual possesses a level of education in excess of that which is required for his/her particular job. In this case an individual can be defined as being overeducated if his/her educational level exceeds the minimal required education to do his/her job. Main educational economics theoretical frameworks provide different explanations about the nature, existence and returns to overeducation.

The standard neo-classical approach (Becker, 1964) to educational participation predicts that (adult and young) workers could be overeducated *only* in the short run[12], whilst firms adjust their production processes in response to any changes in the relative supply of skilled labour[13], or, alternatively, as long as it takes senior workers to find a more appropriate job match and as long as it takes younger workers to adjust their decisions about participation in education.

Some authors argue that persistent overeducation could be consistent with Human Capital Theory (HCT) when work-based human capital investments and/or workers' skill heterogeneity are taken into account[14]. According to these authors, HCT does not reject the hypothesis that two individuals holding different levels of formal education and experience/training on the job could be

[11] . See Ghignoni and Pappadà, 2009.
[12] . As a matter of fact, some studies suggest that overeducation tends to be persistent in nature (Dolton and Vignoles, 2000).
[13] . According to Human Capital Theory earnings equate workers' marginal productivity and should be independent from job characteristics, that is, the returns to surplus and required education should be equal.
[14] . Chevalier, 2003; McGuinness, 2003.

equivalent when performing the same tasks[15]. In particular, labour demand can consider a minimum level of formal education and/or work experience an essential precondition to carry out a particular kind of work, but these two types of education can be considered substitutes in the competencies production function[16], with a higher or lower degree of substitutability[17]. In this case, individuals with more schooling may be compensating for a lack of work-related human capital (i.e. experience or on-the-job training)[18], and the apparent lower earnings of these "falsely-overeducated" (and probably young) individuals may be attributable to an omitted variable problem, i.e., the lack of controls for less formal measures of human capital accumulation[19].

The "explicit" component of individual competencies is also important in *screening/signalling* theories. In this theoretical framework[20] school education would not directly determine the competence/productivity level of workers, and the education degree would be a simple signal to predict individuals' future productivity[21]. Therefore, schooling would not provide a set of knowledge directly utilizable in the labour market, but it would screen out potentially more productive individuals and highlight a series of "virtual productivities", that would take shape on entry to a certain job and in the function of the type of job taken (Thurow, 1974, 1975).

Credentialist theories and Thurow's Job Competition Model (Thurow, 1975) are then inclined to hypothesise a *complementary* relationship between the degree of education and work experience. If the level of education held by the worker is only a "signal" of his/her future and virtual productivity, enclosed therein his/her aptitude to be further trained on the job, it will be up to the firm (that hires a worker on the basis of the "signal") to complete the education through on-the-job training, lifelong learning or learning by doing[22].

Thurow's Job Competition Model is entirely consistent with young and adult workers' (long-term) overeducation. On the one hand, in fact, firms' requirements are fixed according to their production techniques[23], and firms are not able to adapt technology quickly (or at all) to relative skills supply. On the other hand, when the number of educated individuals in the economy

[15] . The idea of "duality" of human capital, composed by "implicit" education and "explicit" education, relates to Becker (1964).

[16] . See *contra*, Duncan and Hoffman, 1981. The authors found evidence to suggest that *general* labour market experience is not treated by employers as a substitute for formal education.

[17] . In this context, an individual who is not overeducated at the moment of his/her entry in the labour market, because in spite of a very high degree of education he/she is lacking in on the job experience, he/she can become overeducated in the future, the higher his/her specific experience becomes(section 5).

[18] . There is evidence to suggest that over (formally) educated workers tend to have lower amounts of informal human capital and vice-versa (Sloane et al., 1999; Sicherman, 1991).

[19] . Alba-Ramírez, 1993, reports a lower return to surplus education even after controlling for on-the-job training.

[20] . See Logossah, 1994, pp. 24-25.

[21] . Empirically, individual performances in the educational system would be a good indicator of future *performances* in the productive system.

[22]. The term *learning by doing* is attributable to Arrow, 1962.

[23] . "The marginal product resides in the job rather than in the individual characteristics" (McGunness, 2003), and worker's wage is pre-determinated by the characteristics of the job, that is the returns to surplus education should be zero.

increases, participating in education becomes more and more necessary to protect one's own place in the queue.

A third theoretical stream, the 'Job Assignment' literature (Sattinger, 1993), represents a middle ground between the two preceding interpretations and states that when heterogeneous workers are assigned to heterogeneous jobs, neither human capital nor job characteristics alone can sufficiently explain all the variations in earnings. Indeed the job allocation process is not a "lottery" and workers found in a particular job are not randomly distributed, but are allocated on the basis of their income maximization choices. (Permanent) overeducation is entirely consistent with Job Assignment models and there is no reason to expect that wages should be independent of job characteristics (as in Human Capital Theory) or of workers' characteristics (as in Job Competition models)[24].

4. Measuring overeducation

Empirical literature suggests various alternative measures of overeducation, the most common of which are: (1) the *objective* measure (Rumberger 1987); (2) the *subjective* measure (Duncan and Hoffman 1981, Hartog and Oosterbeek 1988); (3) the *empirical* measure (Verdugo and Verdugo 1988; Kiker et al. 1997); and (4) The *income ratio* measure (Jensen, 2003).

Unfortunately, these methods can lead to different results for the same individual and can be criticised on a number of grounds[25]. In particular, each of these approaches does not take *individual heterogeneity* into account and assumes that individuals acquiring the same years of education (or possessing similar credentials) will have broadly similar skills. By not allowing for heterogeneity across the skill sets of individuals with similar educational backgrounds, these measurement approaches may be providing inaccurate readings of the incidence and labour market effects of overeducation.

To some extent, the unobserved heterogeneity is related to the distribution of different *skills* among individuals with similar levels of education. In other aspects it refers to individuals' *ability* levels[26] or to *cohort-related* effects resulting from a "grade drift" (Green et al., 2002), that is from a drop in educational standards implying that the level of human capital accumulation associated with various credential has fallen over time[27]. Some studies attempted to control for heterogeneous skills effects by using models that allow for some variability in workers' characteristics. In particular,

[24] . In this context, marginal product and earnings will depend on both the individual's and the job's characteristics.

[25] . See Mason, 1996; Kiker et al., 1997; Green et al., 1999; Borghans and de Grip, 2000; Mendes de Oliveira et al., 2000; Büchel, 2001; Jensen, 2003.

[26] . In this case the availability of data regarding school marks might reduce the problem.

[27]. Most of the literature agrees that a *grade drift* happened after the recent "3+2" University reform in Italy (see Bratti et al., 2007). In this case a young worker possessing a high degree of education with respect to the education level needed to do his/her job would not necessarily be overeducated. With regard to the hypothesis that overeducation would compensate for a "bad" quality of education, see Verhaest and Omey, 2004(a); Ordine and Rose, 2009.

they control for unobserved effects (Bauer, 2002; Chevalier, 2003; Frenette, 2004), or introduce into the analysis some explicit measures of skills related to job performance (Mc Guinnes, 2003)[28].

Economic literature recognizes *on-the-job experience* and/or *on-the-job training* as very important factors of individual heterogeneity. Indeed, the skills of workers with the same degree of education could be very dissimilar depending on their different specific experience and/or the different training to which they were exposed. Unfortunately, internationally comparable data on quality and quantity of training are quite lacking. On the contrary, data on specific experience are easily available and we can take advantage of it. In particular, some empirical work (Espinasse, 1997, 2000; Ghignoni, 2001) proposed a method of measuring overeducation that, starting from the idea of "frontier of competencies" by occupation, links the concept of overeducation to a minimum level of education required for entering into a particular occupation which should be lower, the higher the workers' experience[29].

These authors hypothesize that when firms hire a worker, they buy a combination of "education degree/on-the-job experience" from which they evaluate immediate workers' competencies and anticipate their future productivity. This type of analysis starts from the observation of the coexistence of individuals with very different levels of work experience and formal education in most occupations. In particular, the analysis of the employment structure by occupation, education degree and "potential experience", in various European countries, reveals that among the individuals employed in the same occupation there are both young workers with high level of education and a poor level of work experience, and older workers with a lower level of education and a higher level of work experience (see Frey, Ghignoni and Livraghi, 1998)[30].

If we admit that all (or most of) the individuals employed in a given occupation have the necessary competencies to carry out the related tasks, the different educational levels found in the same occupation highlight a variety of access modalities to a specific job/occupation. In short, access to a certain occupation could occur, in principle, at any moment of an individual's working life, on the condition that he/she possesses a minimum level of competencies, in function (at least) of his/her education degree and of his/her work experience. In this case, it is possible to draw and to estimate, for each occupation, an indifference curve on the plane "years of education/years of experience" characterised by a negative slope, illustrating the substitutability relation (at a macroeconomic level) between these two basic elements of competences (see graph 1).

[28] . The author utilised an explicit self-assessed subjective measure of skill based on the individual's average competency across 16 areas (word-processing; spreadsheets; data management; knowledge of ITC packages; Internet use; corporate finance; product/process management; quality assurance; customer awareness; HRM; corporate statutory requirements; interpersonal skills; leadership skills; organisational skills; team building).

[29] . In this way, HCT is consistent with the existence/persistency of overeducation (see section 3).

[30] . These authors utilised the age of the individual as a proxy of working experience. Occupations are those included in ISCO '88 classification.

Defining, estimating and following the time evolution of the minimum number of years of education required for a particular occupation, as well as the evolution of the number of years of over/under-education in the labour market, is useful in order to clarify the different empirical size of the "supply effect" in relation to the "demand effect".

Concerning this issue, useful information could also derive from the estimation of the economic returns to overeducation (and undereducation). Indeed, beginning from the estimation of the "frontiers" it is possible to evaluate both the returns to the minimum required years of education and to surplus/deficit years of education for each occupation (Rumberger, 1987). In this case, if we observe *at the same time* an increase of the minimum required years of education and an increase of the returns of minimum required education, it means that labour demand has required for more educated workers, so it has been willing to pay them better.

5. The "frontiers of competencies" theoretical model

The idea of "frontier of competencies" by occupation refers to a study of Espinasse and Vincens (1996, 1997) that, criticizing human capital and signalling theories, hypothesizes that both formal education and work experience are fundamental (and substitutional) components of individuals' competences in the labour market. In particular, they hypothesize that to carry on a certain occupation some competences are needed and that such competences are made up by two components: work experience (*a*) and education degree (*d*). If we admit the existence, for each occupation *p*, of a competences' function as follows:

$C_p(a,d)$ such as: $\partial C_p/\partial a \geq 0$ and $\partial C_p/\partial d \geq 0$

we have to admit the existence of a minimum level $C_p^*(a,d)$, that is the lower limit of the acceptable competences to enter into occupation *p*. If we admit that experience and education degree are substitutes, the result is:

$$\frac{\partial C_p^*}{\partial a} \Big/ \frac{\partial C_p^*}{\partial d} < 0$$

and there exists an indifference curve between years of education and years of work experience (or *iso-competence curve*) like that drawn in graph 1.

In this case Θ_p, defined as the whole set of pairs (a,d) such as:

$C_p(a,d) \geq C_p^*(a,d)$

is the domain of the competences exploitable for occupation *p*. It follows that j^{th} individual can enter into occupation *p* if he/she has a level of "competence" $C(a,d)$, such as to satisfy the limit function described by the indifference curve. Moreover, it is possible to hypothesize that all the

individuals situated inside the domain Θ_p are equivalent among them from the labour demand point of view. From the latter hypothesis it should follow that wage is the same for all individuals employed in occupation *p*, regardless of the real level of individual competences.

In this context, overeducation is defined in a non independent way from the level of workers' experience. In graph 2 individuals A, B and C acquired the same number of years of formal education but, bearing in mind their level of work experience, we can assert that individual A received exactly the minimum level of education required to enter the generic occupation *p*, while individual B and individual C are, to different degrees, overeducated. In particular, individual C, having more work experience than individual B, is characterized by a higher level of overeducation than individual B.

The "frontiers of competencies" econometric model

As said in preceding sections, it is possible to estimate on individual data a "frontier of competences" on the plane *years of education/years of experience* for a given occupation, by utilising the production stochastic frontier (or as in this case, the cost stochastic frontier) econometric technique (Aigner, Lovell, Schmidt, 1977).

It is worth recalling that this technique consists in estimating an *isoquant*, in this case an *iso-competences curve*, i.e., a frontier function that gives the *minimum* quantity of two inputs (years of schooling and work experience) at which it is possible to produce some level of output (the level of competences required for occupation *p*). The amount by which an individual with a given level of work experience exceeds the *isoquant* of his/her occupation can be regarded as a measure of overeducation[31].

The econometric estimation of an *isoquant* is obtained by introducing in the regression an asymmetrical composite residual error, resulting from the sum between the normal "centred" residual and a semi-normal, or an exponential, always positive residual[32]. In this way the interpolation of the points cloud is biased downwards, so that most of the points will lie above the estimated curve. Thus, the estimated *isoquant* must be pushed downwards in order to highlight those individuals possessing a higher degree of education than other individuals employed in the same occupation, and characterised by the same amount of work experience (compare individual B to D and individual C to E in graph 2).

This empirical method tends to generate higher rates of overeducation than traditional modal-based or mean-based empirical measures. This does not mean, however, that it necessarily leads to an overestimation of the incidence of overeducation, because it reflects a different definition. A

[31] . See Espinasse, 1997, 2000; Tahar 2000.
[32] . See Farrel, 1957; Kumbhakar and Lovell, 2003.

comparison between the frontier model and traditional empirical measures of overeducation is drawn in graph 3. If we use a modal or a mean-based measure of overeducation, both individual A and individual B can be considered well-matched, apart from their very different work experience. By contrast, the frontier model considers individual B as overeducated because of his/her higher level of work experience.

In any case, empirical measures of overeducation have also been criticized because of the possibility of bias. Indeed, if a particular occupation contains a high proportion of overeducated (undereducated) workers, this will raise (reduce) the occupational average/mode and the corresponding cut-off point, thus underestimating (overestimating) the true level of overeducation[33].

In addition, some *a priori* restrictions on the number of overeducated individuals are required by both traditional empirical methods and the frontier method. For instance, the mode is (by definition) the value that occurs the most frequently in a data set or a probability distribution. In this case a worker is considered well-matched/overeducated/undereducated if his/her education level is equal to/higher than/lower than the modal level of his/her occupation[34]. Thus, we are imposing the restriction that *most* individuals are *perfectly well-matched*, without taking into account their level of work experience. Furthermore, if we use a mean-based measure of overeducation we impose that 68.2% individuals are well-matched (assuming a normal distribution), apart from their work experience. By contrast, the frontier model states that most individuals employed in a given occupation *p* possess *at least* the minimum competences needed for occupation *p* and that undereducated workers are a minority group. This is in line with the hypothesis that firms are prone to hiring overeducated individuals, in particular when the returns to overeducation are low, while they are reluctant to hire undereducated workers.

To empirically take account of the approximately hyperbolic form of the frontiers, consistent with the hypothesis of a decreasing marginal rate of substitution between years of education and years of experience, I estimated a linear model in which the dependent variable is the *inverse* of the years of education (INVEDU) and the independent variables are individual experience (EXP), gender (FEM)[35], the occupation dummies P_i and the cross dummies' occupation/experience I_i, defined as follows:

$$P_i = \int_{0\ otherwise}^{1\ for\ the\ occupation\ i} \qquad I_i = \int_{0\ otherwise}^{EXP\ for\ the\ occupation\ i}$$

In this way I could estimate the frontiers of competences of a set of occupations drawn from the European Community Households Panel data (1995-2001) by the following equation:

[33] . Moreover the assumption of symmetry that the standard deviation method implies seems unrealistic and the choice of cut-off point is always arbitrary.

[34] . See, recently, Pagani and Dell'Aringa, 2009.

[35] . I introduce a "female dummy" to take into account that female workers could have spent some years out of the labour market for maternity reasons.

$$INVEDU = \alpha \ + \beta \ EXP + \gamma \ FEM + \sum_{i=1}^{8} c_i P_i + \sum_{i=1}^{8} d_i I_i + u + v \qquad [1]$$

where: $u \approx N\left(0, \sigma_u^2\right)$ and:

$v \approx +\frac{1}{2} N\left(0, \sigma_v^2\right)$ or, in alternative, $v \approx \exp(\theta)$

Individual experience is approximated (in turn) by the age of the individual (*Age*), the age of the individual minus his/her number of years of education (*Theor_exp*)[36], the individual's generic experience in the labour market (*Gen_exp*) and the individual's specific experience in the current job (*Spec_exp*). This choice is justified because information on workers' actual labour market exposure (i.e. general and specific experience) is characterised by a certain number of missing values (for details and definitions, see Appendix 3), and I preferred controlling the estimation by using experience proxies, such as age or potential experience, as well.

After shedding light on the existence of the frontiers of competences by occupation, it is possible to decompose the initial education (EDU), i.e., the years of education observed for each individual in the sample, into two parts:

1. EF, corresponding to the level of education lying on the frontier function, i.e., the minimum number of years of education required to enter a certain occupation (given individual work experience) which depends on labour demand requirements;
2. RE, corresponding to the overeducation (or undereducation) level for individual j^{th}, which depends on autonomous choices of labour supply with regard to human capital investments. Obviously, $REP = Max(0, RE)$ is the measure of overeducation, whereas $REN = \min(RE, 0)$ is the measure of undereducation.

Given this subdivision of individuals' years of education it is possible to estimate the return to education function as follows:

$$\log(w) = \alpha + \beta_1 X + \beta_2 EXP + \beta_3 EXP^2 + \beta_4 EF + \beta_5 REP + \beta_6 REN + \sum_{i=1}^{8} c_i P_i \qquad [2.a]$$

where w are the hourly wages, X is a vector of personal and job/firm-specific characteristics (gender, age, age squared, part time, type of contract, firm-size and branch of economic activity) correlated with earnings, EXP are different definitions of work experience[37], P_i is a set of dummies for occupation, EF is "required schooling", REP is "years of surplus schooling" above the required level (overeducation) and REN is "years of deficit schooling" below the required level

[36] . Approximating work experience with age minus the number of years of education, minus the six pre-scholar years, common to all individuals, does not change results significantly.

[37] . Different proxies for work experience have been introduced in the estimates both in linear form and in quadratic form. In the latter case I would expect a negative sign, reflecting the usual concavity of the wage profile during the life cycle.

(undereducation). Estimated coefficients for variables EF, REP and REN allow evaluating, respectively, the returns to minimum required schooling, the returns to overeducation and the returns to undereducation.

Results of regression [2.a] could be compared to those deriving from the estimation of a simplified version of the Mincer wage equation (Mincer, 1974), that, taking into consideration only the total years of education of each individual, I can write as follows:

$$\log(w) = \alpha + \beta_1 X + \beta_2 EXP + \beta_3 EXP^2 + \beta_4 EDU + \sum_{i=1}^{8} c_i P_i \qquad [2.b]$$

This empirical analysis could be affected by two main problems.

First of all, some unobservable individual characteristics affecting the probability of being overeducated are also likely to have an impact on earnings (typically: individual ability). The most common way to handle this problem is to include in vector X some indicators of individual educational paths (such as "school grades" or "obtaining degrees on time") as proxies for individual "schooling" ability[38]. Indeed, researchers have traditionally focused on cognitive skills (measured by standardized test scores and aptitude tests) as the primary example of skills influencing labour market outcomes. Nonetheless, some authors point out that non-cognitive skills (such as sociability) strongly affect wages (Heckman et al., 2006)[39]. At the same time, overeducation is associated with a range of personal circumstances including individuals "social network" (Baum et al., 2007). The ECHP survey does not contain detailed information on individual's academic ability, but it comprises abundant information on individual's social skills. These can defined as abilities to set and maintain a wide network of social relations (see Appendix 3 for details). In this case I can include in vector X some indicators of social abilities, which at least partially, allow controlling for unobservable individual heterogeneity.

In the second place, both equation 2.a and 2.b may suffer from a sample selection problem[40], as wages are observable only if the individual actually works. To account for the potential selectivity bias due to endogenous labour force participation I employ the Heckman two-step procedure to estimate the wage functions. This procedure implies including in the wage equation the inverse Mills ratio derived from the estimation of the employment probability function. It also requires at least one variable that does not affect wages but affects the probability of being employed to be incorporated in the selection equation.

Some papers, which are focused on cohorts of recent graduates, use the presence of children to identify female labour force participation (Dolton and Vignoles, 2003). Similar papers on Italian

[38] . See Ghignoni, 2009.
[39]. Following these authors, "sociability" is also strongly related with schooling abilities and grades.
[40] . See Ordine and Rose, 2009; Büchel and Van Ham, 2003; Di Pietro and Cutillo, 2006a.

graduates assert that the presence of children is also likely to (positively) influence male labour force participation, given the greater *financial responsibility* usually borne by men within Italian households (Di Pietro and Cutillo, 2006a). Since the presence of children negatively affects women's participation in the labour market whereas it provides incentive for men's participation, this variable is a suitable selection variable when the analysis is disaggregated by gender. Nevertheless, my analysis is carried out on a sample including males and females together and I need a variable able to influence labour participation in the same way for both genders. In light of this, I use as a selection variable a dummy for single parents with at least one dependent child (see Appendix 3 for details).

Being a single parent with dependent children is likely to be *positively* correlated with the probability of being employed for both women and men. One could object that (in some countries) the presence of welfare benefits for single mothers could discourage their participation in the labour market. However, between 1984 and 1996, changes in tax and transfer programs sharply increased the incentive for single mothers to work[41] in some European and extra-European countries (Meyer and Rosenbaum, 2001).

Furthermore, this variable, conditional on working, should not have a direct influence on labour market outcomes once I control for individual characteristics, working time, type of contract and job and firm-specific variables. The selection of the operative samples and the control variables play a crucial role in this analysis. Indeed, very young single parents might be (less educated and) less able to find a well-matched job. However, my samples include only people aged 25 or more, and divorced, separated and widowers are over-represented compared to teenagers' pregnancies. In addition, single parents may be forced to spend more time with their children. In this case, they may find it difficult to work full-time or, in any case, they may be more involved in contract types characterised by higher risks of overeducation and/or low wages. For this reason, I include in the wage equations some controls for part time and atypical contracts.

Formal tests on the quality and the validity of the instrument are presented in Appendix 2.

7. The results of the empirical analysis

The data used for the estimation of the model presented in the previous section was obtained from the 2nd and the 8th wave (1995-2001)[42] of the European Community Household Panel (ECHP-

[41]. In order to test the influence of being a single parent on male and female labour force participation, I estimated a probit employment function on gender-disaggregated data, including among the regressors education level, age, age squared, "social relations" and a dummy for single parents with dependent children (not shown to save space). These estimates exhibit a significantly positive influence of being a single parent on the probability of having a job, for both males and females in all the five countries.

[42]. Due to a number of missing values on the "type of contract" and "part time/full time" variables in wave 1 (1994) I dropped it from the sample and I started the analysis as from 1995.

Eurostat) for Portugal, Italy, Greece, Spain and the Netherlands. This wide source of data provides comparable information about education and working life of a large sample of individuals in 15 EU countries. Unfortunately, this survey provides data only as far as 2001. Nevertheless, I believe it can provide some useful information about the evolution of overeducation on the threshold of the third millennium.

For the purpose of this analysis the individuals included in the sample have been selected so as to include employees aged between 25 to 65, that is, people between the theoretical age of exit from full-time education and retirement age.

The frontiers of competencies by occupation (equation [1]) have been estimated separately by year and country, with 4 alternative definitions of "experience" (see Appendix 3 for details): Age of the individual (*Age*); Age of the individual minus the number of years of his/her schooling education (*Theor_exp*); Generic experience in the labour market (*Gen_exp*); Specific experience in actual job (*Spec_exp*). A model including both generic and specific experience has also been estimated.

The average values of the observed years of education (EDU), of the "required schooling" (EF), of the years of overeducation (REP) and the years of undereducation (REN) resulting from the estimated models are reported in table 2. In the same table the incidence of overeducation and undereducation by year and country is reported as a percentage (see the 3rd and 6th columns of table 2) [43].

From 1995 to 2001 the "observed years of education" have increased in all countries, in particular in Spain. Nevertheless, in Spain and in the Netherlands the increase in educational attainments of the population proceeded at the same pace with a reduction of the years of overeducation and an increase in the "minimum required" years of schooling. These results are consistent with macroeconomic data reported in section 2 (and in particular with data reported in table 1, Appendix 1) and they should confirm the existence of a labour market capable of absorbing people provided with high levels of human capital. In the same period, in Portugal, Italy and Greece, the increase in the "observed years of education" of the population has been accompanied by the growth of overeducation and by an only slight increase in the "frontier" level of education. In these cases, coherently with macroeconomic data, the dynamics of labour supply's educational levels do not seem to be driven by the exigencies of labour demand.

[43] . More traditional and not fully comparable measures of overeducation (such as modal or mean-based measures of overeducation) show an incidence of overeducation ranging from 27.1% for Greece in 1995 to 7.56% for the Netherlands in 2001.

The different evolution of overeducation and "required" years of schooling in the observed countries went with a different evolution of the returns to required and surplus schooling. The second-stage results of the Heckman models of [2.a] and [2.b] wage equations are given in table 3.

In all countries the returns to required education (EF) are higher than the returns to overeducation (REP). However, returns to required education scarcely increased in Portugal, Italy and Greece between 1995 and 2001, whereas in Spain they have grown sharply in the same period. This should provide further evidence of a prevailing "demand effect" in Spanish labour markets.

In the first three countries in table 3 the (positive) and the (negative) returns to overeducation (REP) and undereducation (REN) do not appear significantly different from zero, with a partial exception for Greece in 1995. In that case the Thurow's Job Competition Model, in which productivity is not embodied in the individual but is entirely determined by job characteristics, is fully proven only for Portugal and Italy. By contrast, in Spain (positive) returns to overeducation and (negative) returns to undereducation are significantly different from zero[44]. This seems to support the Job Assignment hypothesis, in which productivity and wages are determined by the quality of the match between skills supplied by the workers and skills required by the job. In any case, the significant incidence of overeducation/undereducation on wage seems to enlighten the existence of more "meritocratic" labour markets in Spain (and to a certain extent in the Netherlands) than in the other Mediterranean countries.

To investigate the robustness of my results to changes in the definition of "overeducation", I replicated the Heckman estimates of equations 2.a and 2.b by using a modal-based measure of overeducation. In this case the "minimum required years of education" for a given individual correspond to the modal value of the variable "years of schooling" of his/her occupation. Overeducation (undereducation) is ascertained when the individual years of schooling are higher (lower) than the modal level for his/her occupation. Results, not shown here to save space, confirm the conclusions I previously drew on the basis of the definition of overeducation obtained from the frontier model and prove the robustness of the estimations.

In conclusion, the general picture emerging from the estimates indicates that the sharp increase in the educational attainments of labour force in Spanish labour markets should have been driven, for the most part, by a demand–side effect. The prevalence of the "demand effect" would be brought out by both the increase in the minimum required years of education (together with a reduction of overeducation) and the strong increase in the return of minimum required education. By contrast, in the other Mediterranean countries the weakness of the "demand effect", and the probable prevalence of a "supply effect", would be stressed by the increase in the educational attainments of the workforce, accompanied by a very slow increase in the minimum required years

[44]. In the Netherlands only (positive) returns to overeducation are significantly different from zero.

of education and a slight increase in the returns to minimum required education. At the same time, in these countries we observe a growth of the years of overeducation and returns to overeducation not significantly different from zero. In this case, labour demand for more educated workers does not seem to increase and firms would have hired more educated workers simply because the average educational attainments of the population have increased during the years[45].

These findings are consistent with macroeconomic evidence and should confirm that Spanish labour markets have been more dynamic, in term of educational quality of jobs, than labour markets in the other Mediterranean countries and, in particular, that labour demand has been able to closely follow the evolution of human capital in labour supply.

In this case, given the difficulty of young people finding work that characterised the labour markets of the four Mediterranean countries (see section 2), young Spanish workers are likely to run high risks of overeducation, as are young workers in Italy, Greece and Portugal. However, given the prevalence of the "demand effect", young workers' overeducation in Spain should tend to be a transitory phenomenon. In particular, the overeducation of young Spanish workers should diminish more quickly than the overeducation of young workers in Italy, Greece and Portugal during working life. Dutch labour markets seem to be characterized by lower risks of (permanent) overeducation for young (and adult) workers than labour markets in Southern European countries. The next paragraph is dedicated to this issue.

8. Overeducation and cohort effects: "entry condition" or persistent phenomenon?

In this section, in order to analyse the incidence of overeducation among young people and the evolution of overeducation during working life of different cohorts of workers, I used a pseudo-panel method.

In principle, the ECHP is a panel survey and it allows following the evolution of working life of a sample of individuals. Nevertheless, evaluating the career path of individuals needs quite a long period of observation, while the number of individuals interviewed both in wave 2 (1995) and in wave 8 (2001) is very little and it risks providing no significant results. In such a case I preferred using a pseudo-longitudinal analysis, in which I only need two different surveys, referring to two different periods, to follow the trajectory of different cohorts of the population. In practise, individuals aged, for instance, 25 years in the second wave (1995) and those aged 31 years in the eighth wave (2001) collectively represent a group of individuals born during the same year

[45] . Note that, if labour demand for educated workers is stagnant, the growth of the educational level of the population can hardly be driven by the labour demand side.

(1970)[46]. Obviously, this type of analysis does not allow tracing specific individuals but rather the aggregate destination of different cohorts of workers, which is relevant to the aim of this paper.

To analyse the evolution of overeducation of the different cohorts of workers, we need to estimate the change in the professional statuses that different subsequent cohorts of workers, with a hypothetically identical structure by education degree, could have reached during the period under analysis. In other words, we need to estimate the probability of being overeducated, at the same age, of subsequent cohorts of workers by controlling for educational attainments, that is, by artificially providing them with the same structure by education degree constant over the period.

To do so it is possible to estimate the probability of being overeducated in function of age, level of education and cohort of birth with a simple logistic regression that describes the proportion of overeducated (OVER) for a given educational level (EDU) *i*, for a given age (AGE) *j*, and for a given year of birth (COHO) *k*, as in the following equation[47]:

$$\ln[over/(1-OVER)] = EDU_i + AGE_j + COHO_k + const \qquad [3]$$

In this case, if after controlling for educational level and age group, the estimated coefficients for the cohorts groups are not significantly different from zero, the conclusion should be that each cohort of workers, with a given level of education and the same age, has the same probability of being overeducated. By contrast, if the estimated coefficients for the cohorts groups are significantly increasing, passing from the oldest cohort to the youngest one, the conclusion would be that there has been a "devaluation" of education degrees and that the risk of being overeducated is higher for the later cohorts who entered the labour markets.

To deal with the problem of selection bias, I estimated the following bivariate probit model with sample selection[48]:

$$P_{OVER} = \alpha + bX + \sum_{i=1}^{2} c_i EDU_i + \sum_{j=1}^{6} d_j AGEGR_j + \sum_{k=1}^{7} e_k COHOGR_k + \varepsilon_1$$

$$P_{WORK} = \beta Z + \varepsilon_2 \qquad [4]$$

where:

$P_{OVER} = \begin{cases} 1 & \text{if the individual is overeducated} \\ 0 & \text{otherwise} \end{cases}$

$P_{WORK} = \begin{cases} 1 & \text{if the individual actually works} \\ 0 & \text{otherwise} \end{cases}$

[46] . See Appendix 2 for details.
[47] . See Chauvel, 1998.
[48] . Van de Ven and Van Praag, 1981.

X is a vector of individual and job/firm-specific characteristics influencing the probability of overeducation, EDU_i are dummies for education degree, $AGEGR_j$ is a series of dummies for age group, $COHOGR_k$ is a series of dummies for group of years of birth and Z is a set of variables that influence the probability of work.

The key element of this strategy is to select at least one variable that affects the probability of employment and not the overeducation risk. As explained in section 6, I hypothesize that being a single parent with dependent children influences the probability of being part of the labour force but, conditional on working, not the probability of being overeducated once I control for individual characteristics (age, education level), type of contract (part time, atypical contract) and job/firm-specific variables (see Appendix 2 for formal tests).

Results of the estimation of different versions of model [4] are found in table 4.a (overeducation equation) and table 4.b (employment equation).

Such findings show that, even if in my theoretical and econometric model the educational levels required from young workers for each occupation are higher than those required from older workers (to compensate for their lack of work experience), in every country all age groups have a significantly lower probability of being overeducated than the 25-30 age group (see table 4.a).

Actually, as previously pointed out, if overeducation were simply a transitory phenomenon (an "entry condition" in the labour market), destined to be reabsorbed during working life, it would not be a crucial problem. In this regard, some important differences among countries emerge. In particular, whereas 1971-1976 cohorts (aged 25-30 in 2001) have a significantly higher probability of being overeducated than older cohorts in all countries, 1965-1970 cohorts (aged 31-36 in 2001) are characterised by a significantly higher risk of overeducation than older ones in Portugal, Italy and Greece but not in Spain, especially after controlling for sectorial dummies. In the Netherlands only 1971-1976 cohorts are more overeducated than older ones, with and without controlling for sectorial dummies (see again table 4.a). This means that, in the Netherlands and in Spain, 1965-1970 cohorts probably experienced overeducation at the age of 25-30 (that is, at the presumed time of entry in the labour markets), but they are no longer more overeducated than older cohorts in 2001, at the age of 31-36. Econometric findings are consistent with trends in macroeconomic variables reported in section 2 and with results obtained in section 7. In particular, we note that overeducation is a transitory phenomenon in countries where the growth in the educational quality of jobs fits the growth of education in the labour force (Spain and the Netherlands), despite the fact that in Spain (as in Italy, Portugal and Greece) young workers have difficulty entering the labour market and finding a well-matched first job. By contrast, in Italy, Portugal and Greece, where the integration of young people in the labour market and the growth of the educational quality of jobs are lengthy, overeducation is not an entry condition but a persistent phenomenon.

Moreover, whereas in Portugal, Italy and Greece, people in possession of an upper secondary or tertiary degree appear to be significantly more overeducated than people who reach a lower secondary degree (or less) *even after controlling for sectorial dummies*, this does not happen either in Spain or in the Netherlands. That is, in Spain and in the Netherlands people with an upper secondary and a tertiary degree are not more likely to be overeducated than people with a lower degree of education if we control for branch of economic activity.

Gender plays a role in determining individual risk of overeducation. In all Mediterranean countries, in contrast to the Netherlands, female workers would be more overeducated than men if I do not control for branch of economic activity. After controlling for economic sector the significance disappears, pointing out the existence of a widespread sectorial segmentation of female employment in these countries.

Firms' characteristics and type of contract also influence the probability of overeducation. In all countries, excepting the Netherlands, the risk is significantly lower in medium/big firms and in the public sector. Besides this, it is very important to note that in Spain and in the Netherlands temporary employees run significantly lower risks of overeducation than their permanent colleagues. This remarkable difference between Italy/Greece/Portugal, on the one hand, and Spain/Netherlands, on the other hand, highlights a different way of using temporary employment that might have helped young people to reduce long term risks of overeducation in the latter countries.

Table 4.b illustrates the relevance of using a selection model, since I can always reject the null hypothesis of independent equations. As to the sign of correlation coefficient *rho*, economic literature gets mixed results. Some authors obtain a significantly negative coefficient and justify it by asserting that unexplained factors positively affecting the probability of being in employment (ability, talent, aspirations and motivations) are correlated with decreases in overeducation risks that cannot be accounted for by the independent variables included in the model (Di Pietro and Cutillo, 2006a). Others find a positive correlation and explain it with the substitutional character of unemployment and overeducation. In this case, for some people working in a job for which they are overeducated is a strategy chosen in order to avoid unemployment (Büchel and Van Ham, 2003; Ordine and Rose, 2011). Results reported in table 4.b show a strong positive correlation between the error terms of the overeducation and employment equations, confirming that, for some people, the difference between being employed and not being employed depends on having accepted a job for which they are overeducated.

9. Concluding remarks

Overeducation emerges when the supply of highly educated individuals grows faster than the relative demand. In this case, the risk of overeducation should concern the more educated young cohorts rather than the older ones, who entered the labour market during a period when there was a lower availability of high education degrees in the workforce and, other conditions being equal, a lower ratio between the number of highly educated workers and the number of highly-skilled jobs.

Risks of overeducation for young workers should worsen in those countries in which the entry of young people into the labour markets is difficult, both in terms of high youth unemployment rates and in terms of long school-to work transition periods. In this case, on the one hand, well-educated young people could displace less educated young people, settling for jobs not fitting their (high) level of education and, on the other hand, employers could easily re-categorize jobs, which were previously filled by workers who reached a medium level of education, as requiring a high level of education without adjusting relative wages.

However, even in countries where the entry conditions for young people in the labour markets are difficult and lengthy, overeducation should be a *persistent* phenomenon only if the growth in the educational attainments of the population is due to a supply-side effect, rather than a demand-side effect. In the cases where the growth in education level of the labour force is dragged by the growth of the educational quality of jobs, risks of overeducation for young people should diminish during working life, with movement along their career paths. In this framework, some authors (Sloane et al., 1999) point out that a high number of job changes during working life is not sufficient to guarantee a progressive reduction of overeducation, unless local labour markets are characterised by a widespread presence of high-skilled jobs and career opportunities.

In order to analyse this issue, I compared the incidence and the evolution (during 1995-2001) of young people's overeducation in the labour markets of four Mediterranean countries (Portugal, Italy, Greece and Spain), to that of the Netherlands.

Considering that P.I.G.S. countries have been characterised by a rapid growth in educational attainments of young cohorts of workers and a difficult insertion of young people in the labour markets, whereas in the Netherlands the diffusion of high education degrees among the population grew slower and young people are quickly integrated in the labour market, we should expect a much higher risk of overeducation for young workers in the Mediterranean countries than in the Netherlands. Nevertheless, international data shown in section 2 put in evidence that Taylorism and traditional organizations are less diffused in Spain than in other Mediterranean countries and that "lean productions" reached a considerable spread in Spanish labour markets compared to Italy, Greece and Portugal. This might be a signal that the recent increase in aggregate human capital in Spain might have been dragged by labour demand requirements more than in the other Mediterranean countries.

Estimation results, obtained by the competences frontiers model, are consistent with macroeconomic data and confirm these expectations. In 1995 Mediterranean countries were characterized by a higher level of overeducation than in the Netherlands. During 1995-2001 the average level of education of the population has grown in P.I.G.S. countries, and in particular in Spain, faster than in the Netherlands. Nevertheless, both in Spain and in the Netherlands the increase in educational attainments of the population kept pace with an increase in the minimum required years of education (that is, the competences frontiers of most occupations shifted upward) and a reduction of the years of overeducation, whereas in Portugal, Italy and Greece overeducation has grown. Furthermore, the estimation of returns to required and surplus education in 1995 and 2001 brought to light a very tiny increase in the returns to required education in Portugal, Italy and Greece, while they grew very fast in Spain.

Both these results (upward shifts of competences' frontiers and strong increase in the returns to required education) seem to highlight that a large part of the fast growth in the educational attainments of Spanish (young) population has been driven by labour demand. This would mean that (Dutch and) Spanish labour markets have been characterised by a strong "demand effect", whereas the sharp increase in educational attainments in Italy, Portugal and Greece would be driven by a sheer "supply effect".

To test if the prevalence of the "demand effect" in Spanish labour markets has involved a transitoriness of overeducation for young workers in Spain, I applied a pseudo-panel technique to Eurostat data. This method allows tracing the "destination" of different cohorts of workers in local labour markets. Results showed that, even if in the competencies' frontiers model the education degrees required from young workers for acceding to each occupation is necessarily higher than those required from older workers, in all the five countries the 25-30 age group runs the highest risk of overeducation. Nevertheless, in Spain and in the Netherlands 1965-1970 cohorts experimented overeducation only at the time of their presumable entry into the labour markets (in 1995), and they are no longer more overeducated than older cohorts at the end of the period (in 2001), while they remain overeducated in Italy, Portugal and Greece.

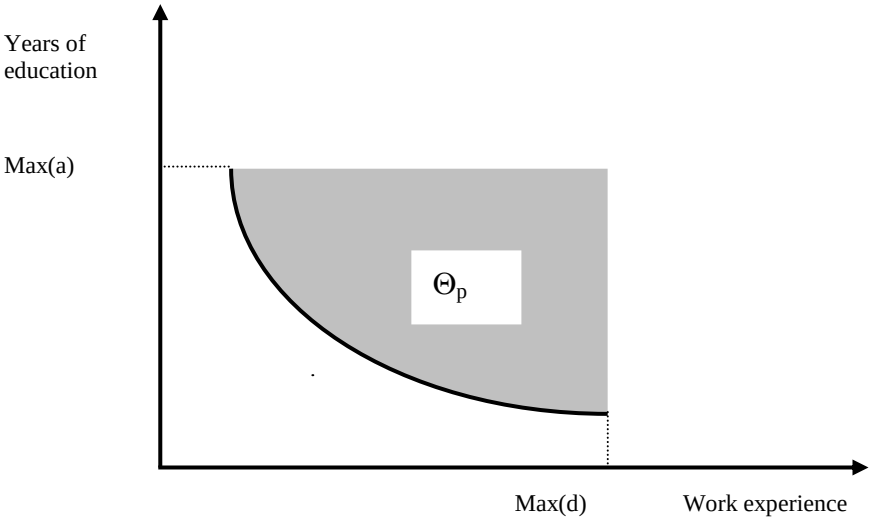
To sum up, the econometric results obtained in this paper are consistent with macroeconomic trends reported in section 2 and (even in the absence of direct evidence) it can be stated that labour demand in the Spanish labour markets was able to absorb the fast evolution of aggregate human capital, and to reduce the risk of permanent overeducation for younger cohorts with successive movements along career paths, notwithstanding the initial difficulty of integration for young people. The analysis carried out in section 8 also shows a remarkable difference in the way of using temporary contracts, between Spain and the other Mediterranean countries, that might have helped

young Spanish workers to reduce risks of permanent overeducation in comparison with their contemporaries in Southern Europe.

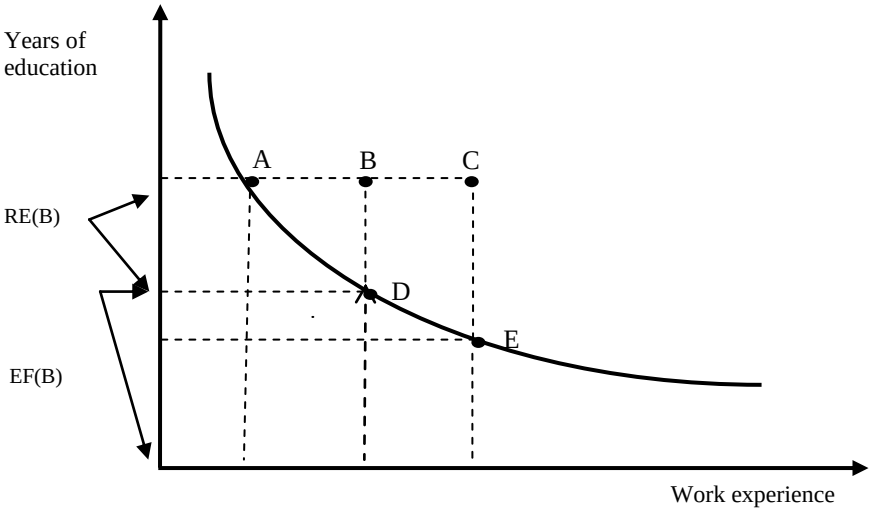
Nevertheless, Spain seems to share with other Southern European countries widespread overeducation and sectorial segmentation of female employment, which do not emerge in the Netherlands. Dutch labour markets have been characterized by more equal opportunities and lower risks of overeducation for all workers, apart from gender, age and year of birth. This is probably due to, among other things, the wide diffusion of high education degrees within the population and high-skilled jobs in the employment structure that they have enjoyed for a much longer period of time than in Mediterranean countries.

Appendix 1 - Figures and Tables

Graph 1 – Frontier of "competencies" for a generic occupation *p*

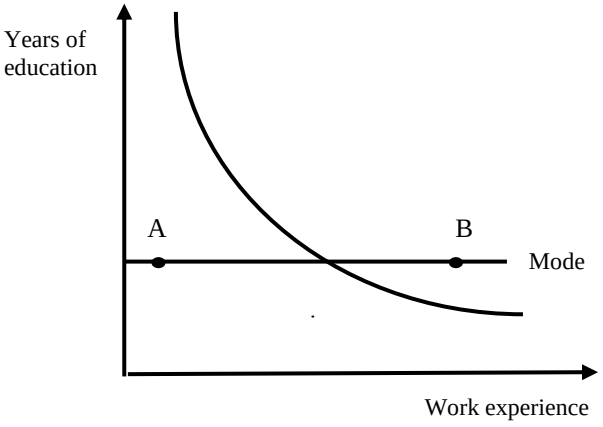


Graph 2 – Minimum required education and overeducation for a generic occupation *p*

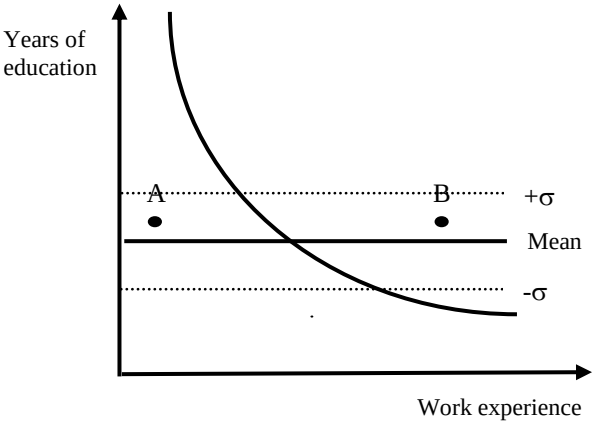


Legenda: EF(B) = minimum number of years of education required to enter a generic occupation *p*, for the individual B;
RE(B) = years of overeducation in occupation *p*, for the individual B.

Graph 3 – A comparison between the frontier model and the traditional empirical measures of overeducation for a generic occupation *p*



Modal-based measure of overeducation



Mean-based measure of overeducation

Table 1 - National differences in organisational models (% of employees in each cluster)

Countries	Advanced form (1+2)	Learning organization (1)	Lean production (2)	Taylorism	Traditional organization
Denmark	81.9	60	21.9	6.8	11.3
Netherlands	***81.2***	***64***	***17.2***	***5.3***	***13.5***
United Kingdom	75.4	34.8	40.6	10.9	13.7
Finland	75.4	47.8	27.6	12.5	12.1
France	71.3	38	33.3	11.1	17.7
Sweden	71.1	52.6	18.5	7.1	21.7
Austria	69	47.5	21.5	13.1	18
Luxembourg	68.2	42.8	25.4	11.9	20
EU-15	*67.3*	*39.1*	*28.2*	*13.6*	*19.1*
Belgium	64	38.9	25.1	13.9	22.1
Germany	63.9	44.3	19.6	14.3	21.9
Ireland	61.8	24	37.8	20.7	17.6
Spain	**58.9**	**20.1**	**38.8**	**18.5**	**22.5**
Portugal	**54.2**	**26.1**	**28.1**	**23**	**22.8**
Italy	**53.6**	**30**	**23.6**	**20.9**	**25.4**
Greece	**44.3**	**18.7**	**25.6**	**28**	**27.7**

Source: Third European Working Condition Survey (2000), quoted in Employment in Europe, 2007, p. 148, table 8

Table 2 - Overeducation and undereducation by country, 1995-2001

Variable (average values)	Definition of "experience" utilised in the estimation of equation [1]*	1995			2001		
		% of over/under educated	Mean	St.dev	% of over/under educated	Mean	St.dev
Portugal							
Actual years of education (EDU)			9.2935	3.2195		10.1133	4.0352
Minimum required years of education (EF)	Age		7.8001	0.5622		7.8212	0.9520
	Theor_exp		7.9345	1.1459		8.0635	1.6837
	Gen_exp		7.8367	0.7761		7.8491	1.0741
	Spec_exp		8.4446	0.5623		8.6578	0.7378
	Spec&gen_exp		8.7891	0.6583		8.8160	0.9725
Years of overeducation (REP)	Age	52.56%	1.4891	2.9574	52.82%	2.3206	3.4243
	Theor_exp	52.20%	1.3981	2.6748	53.31%	2.1086	3.0317
	Gen_exp	52.38%	1.4891	2.7975	53.15%	2.2728	3.3314
	Spec_exp	52.61%	2.0467	3.5726	53.89%	2.3626	3.4988
	Spec&gen_exp	52.78%	2.0327	3.5730	53.58%	2.4069	3.4306
Years of undereducation (REN)	Age	47.44%	-0.9836	0.8867	47.18%	-0.6059	0.9846
	Theor_exp	47.80%	-0.3128	0.5987	46.69%	-0.5965	0.7581
	Gen_exp	47.62%	-0.5871	0.9881	46.85%	-0.5590	0.9165
	Spec_exp	47.39%	-0.7728	0.9765	46.11%	-0.7638	0.8769
	Spec&gen_exp	47.22%	-0.4865	0.6478	46.42%	-0.5641	0.9949
Italy							
Actual years of education (EDU)			11.2234	3.8934		11.8755	3.9909
Minimum required years of education (EF)	Age		8.5845	1.4825		9.6278	1.8748
	Theor_exp		8.7389	1.7724		10.2348	2.3045
	Gen_exp		8.6002	1.5309		9.8183	2.0035
	Spec_exp		8.6935	1.5215		9.8384	1.9075
	Spec&gen_exp		8.9478	1.7005		10.8845	2.4081
Years of overeducation (REP)	Age	51.74%	3.0973	2.9914	51.76%	3.3223	2.8363
	Theor_exp	52.23%	2.8712	2.7865	52.91%	2.9361	2.4192
	Gen_exp	53.14%	2.9989	2.9013	53.22%	3.1852	2.7059
	Spec_exp	53.68%	2.9906	2.9067	53.73%	3.5367	2.7252
	Spec&gen_exp	52.63%	2.9701	2.8138	52.71%	3.0662	2.3282
Years of undereducation (REN)	Age	48.26%	-0.9988	0.9273	48.24%	-0.7897	1.0209
	Theor_exp	47.77%	-0.9029	0.9382	47.09%	-0.9733	0.9542
	Gen_exp	46.86%	-0.9989	0.9325	46.78%	-0.8857	0.9946
	Spec_exp	46.32%	-1.0012	0.8456	46.27%	-0.7970	1.0037
	Spec&gen_exp	47.37%	-0.9356	0.9106	47.29%	-1.3378	1.1771
Greece							
Actual years of education (EDU)			12.2700	4.9454		12.3521	4.6228
Minimum required years of education (EF)	Age		8.7667	2.4113		9.1108	2.1630
	Theor_exp		9.8120	2.7783		10.1931	2.7076
	Gen_exp		8.8832	2.4196		8.9744	2.1503
	Spec_exp		8.6923	2.3724		8.8719	2.0927
	Spec&gen_exp		8.7972	2.4413		9.2753	2.2506

Years of overeducation (REP)	Age	54.42%	3.6556	3.5802	54.45%	3.6959	3.2614
	Theor_exp	54.57%	3.2712	3.0083	54.58%	3.2891	2.6692
	Gen_exp	55.83%	3.6401	3.5621	56.46%	3.6748	3.2819
	Spec_exp	56.09%	3.6578	3.6679	56.69%	4.0144	3.3960
	Spec&gen_exp	55.93%	3.6481	3.5399	55.96%	3.8500	3.1656
Years of undereducation (REN)	Age	45.58%	-0.8365	1.1892	45.55%	-0.8754	1.0169
	Theor_exp	45.43%	-0.7824	0.8500	45.42%	-1.0234	0.9804
	Gen_exp	44.17%	-0.8202	1.1323	43.54%	-0.8712	0.9553
	Spec_exp	43.91%	-1.3599	1.3245	43.31%	-0.5489	1.0068
	Spec&gen_exp	44.07%	-0.7891	1.1327	44.04%	-0.6828	0.8490
Spain							
Actual years of education (EDU)			11.8721	5.3025		13.0763	5.2923
Minimum required years of education (EF)	Age		8.1002	1.3215		10.4907	1.9850
	Theor_exp		8.6100	2.3451		11.3335	2.8055
	Gen_exp		8.1341	1.5894		10.5591	2.1789
	Spec_exp		8.0199	1.2222		10.4315	1.7689
	Spec&gen_exp		8.1306	1.5723		10.4997	1.9919
Years of overeducation (REP)	Age	53.11%	3.8587	4.3259	51.01%	1.6131	4.5324
	Theor_exp	53.02%	3.3594	3.7090	50.97%	2.0677	3.5893
	Gen_exp	54.78%	3.7899	4.3456	52.01%	1.5391	4.4720
	Spec_exp	54.08%	3.9212	4.4502	53.46%	1.8203	4.6314
	Spec&gen_exp	55.69%	3.8578	4.2917	52.49%	1.7613	4.5205
Years of undereducation (REN)	Age	46.89%	-0.4578	0.9202	48.99%	-0.2793	0.8175
	Theor_exp	46.98%	-0.7480	0.8875	49.03%	-0.6653	0.8016
	Gen_exp	45.22%	-0.5113	0.8302	47.99%	-0.3880	0.8218
	Spec_exp	45.92%	-0.7579	1.4029	46.54%	-0.4587	1.0648
	Spec&gen_exp	44.31%	-0.4109	0.9307	47.51%	-0.3014	0.7562
The Netherlands							
Actual years of education (EDU)			14.0612	3.7892		14.3942	1.4975
Minimum required years of education (EF)	Age		13.3304	2.1396		13.6540	0.8456
	Theor_exp		13.4297	2.4312		13.7837	0.0204
	Gen_exp		13.3371	2.2234		13.9564	0.3575
	Spec_exp		13.4791	2.1256		13.8439	0.4570
	Spec&gen_exp		13.4877	2.1661		13.9757	0.4587
Years of overeducation (REP)	Age	50.97%	1.4999	2.0792	50.77%	0.3570	1.7153
	Theor_exp	51.88%	1.2585	1.9323	51.01%	0.4501	2.1941
	Gen_exp	50.34%	1.4013	2.0527	50.18%	0.5692	1.6953
	Spec_exp	51.69%	1.3923	2.0683	51.43%	0.5333	1.7579
	Spec&gen_exp	51.30%	1.3894	2.0548	51.21%	0.5410	1.7471
Years of undereducation (REN)	Age	49.03%	-0.1502	1.9202	49.23%	-0.0985	1.8867
	Theor_exp	48.12%	-0.1303	1.7319	48.99%	-0.0895	1.6598
	Gen_exp	49.66%	-0.2699	1.9222	49.82%	-0.2396	1.9258
	Spec_exp	48.31%	-0.2697	1.9527	48.57%	-0.2438	1.9468
	Spec&gen_exp	48.70%	-0.2409	1.9696	48.79%	-0.1785	1.9546

Age= Age of the individual; Theor_exp = Age of the individual minus the number of years of his schooling education; Gen_exp = Generic experience on the labour market; Spec_exp = Specific experience in actual job; Spec&gen_exp: model with both general and specific experience. Exponential positive residuals with density: $f(v) = \theta e^{-\theta v}$

Table 3 – Returns to required, over and under education by country, 1995-2001; Heckman sample selection model; definition of overeducation based on "frontier model"

Variables	Coef.	t	P>|t|	Coef.	t	P>|t|
	1995			2001		
Portugal						
Min. required years of education (EF)*	0.0276	2.40	0.017	0.0297	9.08	0.000
Years of overeducation (REP)*	0.0096	0.12	0.901	0.0147	0.76	0.445
Years of undereducation (REN)*	-0.0570	-1.15	0.250	-0.0010	-0.53	0.595
Mills	0.1762	2.65	0.008	0.1924	3.91	0.000
Actual years of education**	0.0305	6.22	0.000	0.0361	18.95	0.000
Mills	0.1899	1.96	0.050	0.2112	2.41	0.016
Italy						
Min. required years of education (EF)*	0.0359	2.42	0.016	0.0388	3.03	0.003
Years of overeducation (REP)*	0.0565	0.52	0.606	0.0262	0.35	0.726
Years of undereducation (REN)*	-0.0504	-1.08	0.281	-0.0181	-0.65	0.514
Mills	0.2232	2.67	0.008	0.2134	2.38	0.018
Actual years of education**	0.0391	7.26	0.000	0.0425	10.80	0.000
Mills	0.1925	2.57	0.010	0.2119	2.34	0.019
Greece						
Min. required years of education (EF)*	0.0208	3.68	0.000	0.0233	3.13	0.002
Years of overeducation (REP)*	0.0152	1.99	0.047	0.0237	1.82	0.069
Years of undereducation (REN)*	-0.0039	-0.27	0.789	-0.0304	-0.43	0.667
Mills	0.3312	2.55	0.011	0.3121	4.25	0.000
Actual years of education**	0.0237	4.95	0.000	0.0253	11.89	0.000
Mills	0.2984	2.12	0.034	0.2889	3.77	0.000
Spain						
Min. required years of education (EF)*	0.0195	5.30	0.000	0.0594	4.21	0.000
Years of overeducation (REP)*	0.0103	2.51	0.012	0.0118	4.50	0.000
Years of undereducation (REN)*	-0.0166	-1.63	0.102	-0.0354	-2.02	0.043
Mills	0.1881	3.38	0.001	0.1812	2.99	0.003
Actual years of education**	0.0143	7.52	0.000	0.0430	9.53	0.000
Mills	0.1923	3.14	0.002	0.1716	2.25	0.025
The Netherlands						
Min. required years of education (EF)*	0.0162	5.99	0.000	0.0207	3.83	0.000
Years of overeducation (REP)*	0.0089	2.27	0.023	0.0065	3.99	0.000
Years of undereducation (REN)*	-0.0006	-1.70	0.089	-0.0098	-0.90	0.368
Mills	0.1324	2.97	0.003	0.1253	2.37	0.018
Actual years of education**	0.0194	6.35	0.000	0.0212	5.85	0.000
Mills	0.1302	3.33	0.001	0.1298	2.06	0.039

* equation [2.a]; ** equation [2.b]. Dependent variable: log of hourly wages, control variables: gender, age, age squared, generic experience, generic experience squared, specific experience, specific experience squared, firm size, type of contracts, part time, occupations, branch of economic activity and "social relations" as proxies for individual non-cognitive ability.
"Mills" is the inverse Mills ratio from probit regression of the employment function (control variables: gender, education level, age, age squared, "social relations" and a dummy for single parents with dependent children)

Table 4.a – Probability of overeducation (bivariate probit model *with* sample selection) by group of cohorts and country

Variables	Portugal		Italy		Greece		Spain		The Netherlands	
	Mod. 1	Mod. 2	Mod. 1	Mod. 2	Mod. 1	Mod. 2	Mod. 1	Mod. 2	Mod. 1	Mod. 2
Overeducation equation										
Female	0.1321**	0.1203	0.0532**	0.0412	0.1524**	0.1246	0.1131**	0.0659	-0.1124*	-0.0022
Level of education										
Less than upp. Sec. (ref.)										
Upper secondary level	0.0659*	0.0257*	0.0824*	0.0798*	0.0723*	0.0568*	0.0324*	0.0099	0.0497*	0.0031
Tertiary level	0.0769**	0.0298*	0.0759**	0.1001*	0.0989*	0.0390*	0.0864*	0.0399	0.0731*	0.0327
Age group										
25-30 (ref.)										
31-36	-0.1521*	-0.1321*	-0.1131*	-0.0541*	-0.2909*	-0.1499*	-0.0178*	-0.0119*	-0.0568*	-0.0523*
37-42	-0.1629*	-0.1332*	-0.1922*	-0.1632*	-0.2768**	-0.2203**	-0.0543*	-0.0253*	-0.0611*	-0.0671*
43-48	-0.1794**	-0.1424**	-0.4523**	-0.3923*	-0.3106**	-0.2786**	-0.0239*	-0.0229*	-0.0324*	-0.0313*
49-54	-0.2367**	-0.1447**	-0.5002**	-0.5502**	-0.3341**	0.2855**	-0.0269*	-0.0235*	-0.0338*	-0.0175*
55-60	-0.3232**	-0.1539**	-0.5967**	-0.6024**	-0.3323**	-0.2579**	-0.0232**	-0.0283**	-0.0312*	-0.0199*
61-66	-0.3417**	-0.1678**	-0.6223**	-0.6113**	-0.3391**	-0.2556**	-0.0213**	-0.0114**	-0.0218**	-0.0120*
Cohort group										
1929-1934 (ref.)										
1935-1940	0.0212	-0.0031	-0.01423	-0.0162	0.0367	0.0218	-0.0385	0.0002	0.0091	-0.0012
1941-1946	0.0523	-0.0123	-0.0146	-0.0199	0.0911	0.0568	-0.0256	0.0134	0.0258	0.0357
1947-1952	0.2433	0.2456	0.1089	0.1106	0.2018	0.2104	0.0297	0.0143	0.0155	0.0597
1953-1958	0.3421	0.2578	0.1521	0.1204	0.1566	0.1459	0.0328	0.0295	0.0958	0.0756
1959-1964	0.4009	0.3022	0.3333	0.3086	0.3016	0.2254	0.0321	0.0269	0.0249	0.0659
1965-1970	0.5008**	0.4307*	0.4302**	0.4167**	0.3903**	0.2293**	0.0538*	0.0358	0.0264	0.0321
1971-1976	0.6098**	0.5431**	0.5134**	0.4398**	0.4449**	0.3829**	0.1325**	0.1328**	0.0298*	0.0238*
Firm size										
Small firm (ref. cat.)										
Medium firm	-0.1091*	-0.0438*	-0.0432*	-0.0398*	-0.0916*	-0.0891*	-0.1303*	-0.0854*	-0.0322*	0.0199
Big firm	-0.2310**	-0.0798**	-0.1210**	-0.0452**	-0.0622**	-0.0572**	-0.0498*	-0.0323*	-0.1025*	0.0321
Public sector	-0.1821**	-0.1921**	-0.2431**	-0.1603**	-0.4299**	-0.3002**	-0.2594*	-0.0821*	-0.2301	-0.0523
Permanent employment	0.0456	0.0113	0.0133	0.0210	-0.0383	-0.0318	0.0521*	0.0421*	0.0426*	0.0013*
Part time	0.2123	0.1931	0.1456	0.1322	0.1090	0.0908	0.0011	0.0092	0.2139	0.1877
Social relations (1)	-0.0134	-0.0098	-0.0321*	-0.0190	-0.0231	-0.0125	-0.0917	-0.0856	-0.0012	-0.0009
Social relations (2)	-0.0194	-0.0172	-0.0243	-0.0224	-0.0453	-0.0321	-0.0786	-0.0657	-0.0031	-0.0011
Social relations (3)	-0.0223	-0.0134	-0.0175*	-0.0043	-0.0328	-0.0256	-0.0676	-0.0433	-0.0124	-0.0043
Constant	0.6928**	0.6124**	1.3591**	0.9898**	0.8421**	0.7892**	1.6386**	1.3394**	0.7909**	0.6798**
Dummies for branch of economic activity	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
N	10,189	10,181	12,921	12,911	8,932	8,925	11,059	11,043	9,530	9,519

Table 4.b – Probability of employment (selection equation) by group of cohorts and country

Variables	Portugal		Italy		Greece		Spain		The Netherlands	
	Mod. 1	Mod. 2	Mod. 1	Mod. 2	Mod. 1	Mod. 2	Mod. 1	Mod. 2	Mod. 1	Mod. 2
Employment selection equation										
Female	-0.2031**	-0.2024**	-0.2782**	-0.2985**	-0.2851**	-0.2621**	-0.1231*	-0.1135*	-0.0145	-0.0008
Level of education										
Less than upp. sec. (ref.)										
Upper secondary level	0.1932*	0.1909*	0.1678*	0.1602*	0.1723*	0.1698*	0.0399*	0.0395*	0.0121	0.0012
Tertiary level	0.1312**	0.1254**	0.1524**	0.1503*	0.1423*	0.1352*	0.0791*	0.0983*	0.0115	0.0110
Age group										
25-30 (ref.)										
31-36	0.1538*	0.1542*	0.1325*	0.1366*	0.1421*	0.1234*	0.1529*	0.1516*	0.1022	0.1821
37-42	0.2001**	0.2013**	0.1609**	0.1567*	0.1678*	0.1232*	0.1629*	0.1621*	0.1032*	0.1398*
43-48	0.1922**	0.1998**	0.1637**	0.1595**	0.1324*	0.1222**	0.1601*	0.1603*	0.1194*	0.1199*
49-54	0.1607**	0.1657**	0.1618**	0.1806**	0.1789**	0.1523**	0.1612**	0.1616**	0.1223*	0.1235*
55-60	0.1499**	0.1413**	0.1722**	0.1721**	0.1694**	0.1697**	0.1538**	0.1541**	0.1769*	0.1762*
61-66	-0.0659*	-0.0724*	-0.0324*	-0.0577*	-0.0694*	-0.0564*	-0.1356*	-0.1306*	-0.1228	0.1780
Cohort group										
1929-1934 (ref.)										
1935-1940	0.0214	0.0150	0.0673	0.0256	0.0431	0.0012	0.0713	0.0638	0.0121	0.0080
1941-1946	0.0254*	0.0108*	0.0391*	0.0217*	0.0091*	0.0083*	0.0356*	0.0215*	0.0102*	0.0061
1947-1952	0.1591**	0.1688**	0.0098*	0.1391*	0.1722*	0.1624*	0.1521*	0.1303*	0.0691*	0.0598*
1953-1958	0.1234**	0.1422**	0.1562**	0.1681*	0.1701*	0.1523*	0.1891*	0.1209*	0.0194*	0.0222*
1959-1964	0.1199**	0.1014**	0.3009**	0.1822**	0.1560**	0.1568**	0.1394**	0.1308**	0.0126**	0.0131**
1965-1970	0.1202**	0.1390**	0.2108**	0.1361**	0.1509**	0.1668**	0.0991**	0.0983**	0.0777**	0.0702**
1971-1976	0.1821*	0.1815*	0.2432*	0.1628*	0.1692*	0.1705*	0.1722*	0.1809*	0.0621**	0.0633*
Social relations (1)	0.0155	0.0012	0.0190*	0.0161	0.0134	0.0211	0.0617	0.0523	0.0066	0.0026
Social relations (2)	0.0023	0.0009	0.0257	0.0143	0.0214	0.0121	0.0511	0.0444	0.0087	0.0003
Social relations (3)	0.0223	0.0137	0.0178*	0.0059	0.0422	0.0356	0.0718	0.0512	0.0042	0.0023
Single parents with dependent children	0.4122**	0.3981**	0.5226**	0.5312**	0.2531**	0.2498**	0.3912**	0.3824**	0.1231*	0.1229*
Constant	1.9908**	1.3616**	1.5421**	1.1099**	1.7923**	1.7724**	1.1328**	1.1214**	1.0729**	1.0492**
N	14,339	14,328	21,698	21,685	14,357	14,346	19,336	19,315	13,238	13,223
Correlation coefficient (ρ)	0.5893**	0.5572**	0.4111**	0.3899**	0.5172**	0.5003**	0.3324*	0.3248*	0.1944**	0.1817**
Wald test for independent equations	$X^2(1)$=25.9 P=0.0000	$X^2(1)$=22.1 P=0.0000	$X^2(1)$=18.6 P=0.0000	$X^2(1)$=17.4 P=0.0000	$X^2(1)$=23.1 P=0.0000	$X^2(1)$=21.9 P=0.0000	$X^2(1)$=17.5 P=0.0000	$X^2(1)$=15.2 P=0.0000	$X^2(1)$=7.67 P=0.0056	$X^2(1)$=4.49 P=0.0341

* 5 percent significance; ** 1 percent significance.

Appendix 2 – Tests on the quality and the validity of the instrument

As pointed out in preceding sections, the estimation of a selection model needs at least one instrumental variable that affects the probability of employment and not wages/overeducation risk. In this section I test the quality and the validity of the instrumental variable I use in this paper (single parent with dependent children).

Instrumental quality is ensured if there is a strong correlation between the instrument and the probability of working. A statistic commonly used in order to test this condition (Bound et al., 1995) is the R^2 of the first stage regression with the included instrument "partialled-out" (for an application to the analysis of overeducation, see Di Pietro and Cutillo, 2006b). In the employment equations used to estimate the Heckman sample selection models reported in table 3, the partial R^2 on the excluded instrument are 0.7326 (Portugal), 0.7129 (Italy), 0.7008 (Greece), 0.7025 (Spain), 0.6872 (The Netherlands). In the employment equations used to estimate the bivariate probit models reported in table 4.a, the partial R^2 on the excluded instrument are 0.7291 (Portugal), 0.7086 (Italy), 0.6991 (Greece), 0.6921 (Spain), 0.6798 (The Netherlands). Thus, the tests indicate that the instrument is legitimate.

Instrumental validity is ensured if the instrument can be legitimately excluded form the wage/probability of overeducation equation. This assumption is often checked through the Sargan test. Nevertheless, this test is valid only in case of over-identification (i.e. the number of valid instruments exceeds the number of endogenous variables), which is not my case. Following the suggestion of Cutillo and Ceccarelli (2010), I checked the validity of the instrument through the approach of Dolton and Vignoles (2002). According to these authors, a valid instrument must be uncorrelated with the error term of the outcome equation, and thus it should not affect wages/probability of overeducation conditional on the included explanatory variables. When the residuals from the wage equations reported in table 3 were regressed on the instrument, I obtained R^2= 0.0412 (Portugal), R^2= 0.0538 (Italy), R^2= 0.0397 (Greece), R^2= 0.0219 (Spain), R^2= 0.0185 (The Netherlands). When the residuals from the overeducation equations reported in table 4.a were regressed on the instrument, I obtained R^2= 0.0010 (Portugal), R^2= 0.0008 (Italy), R^2= 0.0021 (Greece), R^2= 0.0013 (Spain), R^2= 0.0003 (The Netherlands). This indicates that the instrument does not explain any significant variation in the residual variability and hence is valid.

Appendix 3 – Data and variables description

Data are drawn from European Community Household Panel (ECHP), Eurostat. Due to a number of missing values on the "type of contract" and "part time/full time" variables in wave 1 (1994), I dropped it from the analysis and I used wave 2 (1995) and wave 8 (2001). I selected all the employees, that is, all the individuals for which the answer to question PE003 in the ECHP questionnaire *(ILO main activity status at the time of interview*) is equal to 1 (*normally working*: working 15+ hours / week) or equal to 2 (*currently working*: working less than 15 hours / week); aged between 25 and 65.

$INVEDU = \frac{1}{years\ of\ schooling}$; "years of schooling" refer to question PT022 (*Highest level of general or higher education completed*);

Female: dummy variable built on the basis of question PD004, (female=1; male=0);

Age: age of the individual at the time of the survey, question PD003.

Theoretical experience: variable built on the basis of questions PD003 and PT022 as follows:

$Theoretical\ experience = age\ at\ the\ time\ of\ the\ survey\ -\ years\ of\ schooling$;

Specific Experience: variable built on the basis of question PE011 (*Year of start of current job*) as follows:

$Specific\ experience = year\ of\ the\ survey\ -\ year\ of\ start\ of\ current\ job$;

Generic experience: variable built on the basis of question PE039 (*How old were you when you began your working life, that is, started your first job or business*) as follows:

$Generic\ experience = age\ at\ the\ time\ of\ the\ survey\ -\ age\ at\ first\ job$;

Occupation: dummies variables built on question PE006C. Occupations taken into consideration are: Legislators, Senior Officials and Managers; Professionals; Technicians and Associate Professionals; Clerks; Service Workers and Shop and Market Sales Workers; Skilled Agricultural and Fishery Workers; Craft and Related Trades Workers; Plant and Machine Operators and Assemblers; *Ref category*: Elementary Occupations;

Tab. A1 – Frontier equations: number of observations and missing values

Year and country	**1995 (W2)**					**2001 (W8)**				
	PT	**IT**	**GR**	**SP**	**NE**	**PT**	**IT**	**GR**	**SP**	**NE**
N	5065	7249	5119	6252	4665	5067	5679	3823	4811	4877
Missing values:										
Age	-	-	-	-	-	-	-	-	-	-
Years of schooling	2.98%	1.51%	0.01%	-	0.81%	-	-	-	-	-
Specific experience	*2.96%*	*7.51%*	*1.54%*	*4.53%*	*4.71%*	*6.57%*	*8.47%*	*7.11%*	*8.52%*	*8.05%*
Generic experience	0.81%	3.23%	1.12%	0.66%	0.07%	2.07%	4.47%	1.91%	1.91%	1.57%
Occupation	2.51%	1.69%	1.01%	0.42%	1.21%	0.83%	2.61%	0.89%	0.58%	2.20%

Log (hourly wage): variable built on the basis of question PI211M (*Current wage and salary earnings, net-monthly*) and of question PE005 (*Total number of hours worked per week*).

Social relations (3 proxies for "non-cognitive ability"):

1. **member**, dummy variable built on question PR002 (*Are you a member of any club, such as a sport or entertainment club, a local or neighbourhood group, a party etc.?*), 1=yes; 0=no;
2. **talk**, dummy variable built on question PR003 (*How often do you talk to any of your neighbours?*), 1=on most days; 0=else;
3. **meet people**, dummy variable built on question PR004 (*How often do you meet friends or relatives not living with you, whether here at home or elsewhere?*), 1=on most days; 0=else;

$\mathbf{P_{over}}$: dummy variable equal to 1 if the individual is overeducated; 0 otherwise;

$\mathbf{P_{work}}$: dummy built on question PE003 (*(ILO main activity status at the time of interview*); 1= normally working (working 15+ hours / week) or currently working (working less than 15 hours / week); 0 otherwise (unemployed, discouraged worker, economically inactive);

Level of education: dummies variables built on the basis of question PT022 (*Highest level of general or higher education completed*); ref. cat.: less than upper secondary education;

Firm size: dummies variables built on question PE008 (*Number of regular paid employees in the local unit in current job*), small firms (*ref. cat.)*, from 0 to 49 employees; medium firms, from 50 to 499 employees; big firms, 500 or more employees;

Public: dummy variable built on question PE009 (*Current job in public or private sector?*), 1= public; 0=private;

Permanent employment: dummy variable built on question PE024 (*What type of employment contract do you have in your main job?*), permanent employment=1; fixed-term or short-term contract, casual work with no contract, some other working arrangement=0;

Part time: dummy variable built on question PE005c (*Main job; part time/full time*), part time=1; full time=0.

Branch of economic activity: dummies variables built on question PE007B. Ref. category: Manufacturing industries;

Single parent with dependent children: dummy variable built on question HD006a (*Household type, economical typology*).

Tab. A2– Matches between *age groups* and *cohorts of birth*

Age at the time of the survey (question PD003)	**Cohort of birth in:**	
	Survey 1995	**Survey 2001**
25-30	1970-1965	*1976-1971 (ref. cat.)*
31-36	1964-1959	1970-1965
37-42	1958-1953	1964-1959
43-48	1952-1947	1958-1953
49-54	1946-1941	1952-1947
55-60	1940-1935	1946-1941
61-66 (ref. cat.)	1934-1929	1940-1935

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